*BY ORDER OF THE COMMANDER*
*AIR FORCE MATERIEL COMMAND*

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*Maintenance*

# *ANALYTICAL CONDITION INSPECTION (ACI) PROGRAMS*



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This instruction implements AFPD 21-1, Managing Aerospace Equipment Maintenance. It provides guidance and procedures for establishing and monitoring ACI programs for aerospace equipment.

## *SUMMARY OF CHANGES*

This revision aligns the instruction with AFPD 21-1.

**1. Purpose.** ACI programs reveal defects that may not otherwise be detected through normal technical order and programmed depot maintenance (PDM) inspections. They provide data for engineering and technical evaluations of the relative condition of the total mission, design and series (MDS) aircraft force. Data generated through ACIs is used to refine mandatory aircraft inspection programs (field and depot).

**2. Terms and Abbreviations.** Terms and abbreviations used in this instruction are listed in attachment 1.

**3. Procedures.** Any item or area deemed applicable by the system program director (SPD) may be included in an ACI program. ACI programs do not cover all areas of aircraft and systems every year; rather, the inspection and evaluation process is continuous to ensure airworthiness.

3.1. Results from the Aircraft Structural Integrity Program (ASIP), failure data, and material deficiency and accident or incident reports will be the primary sources for determining which items or areas require inspection and evaluation on an annual basis. Also, highly stressed areas, ASIP identified critical points, and areas subject to corrosion, such as wheel wells, surface controls, bomb bays, and lower wing surfaces, will be carefully screened for inclusion in an annual ACI program.

3.2. Areas such as subsystems or secondary structures are scheduled for inspection and evaluation using a phased ACI approach. For example, fuel systems and life support systems may be inspected and evaluated 1 year, flight controls and hydraulic systems the next year, and avionics and secondary structures the third year.

3.3. ACI data will be used to determine the condition of the remaining MDS force. When necessary, additional data can be gathered by:

3.3.1. Sampling additional aircraft in for PDM.

3.3.2. Initiating field level inspections.

3.3.3. Evaluating existing assets in supply.

3.3.4. Accomplishing further engineering analysis.

3.4. The ACI program will be accomplished concurrently with modification and PDM program requirements.

**4. Initiating ACI Programs.** The SPD will determine when an ACI program should be initiated and will maintain the technical data used to support the decision. As general guidance for trainer or fighter type aerospace systems, consideration should be given to initiating an ACI program when four or more aircraft have been in the operational inventory for 3 years or have attained 1,000 flight hours of service and for bomber, cargo or tanker type aerospace systems when four or more aircraft have been in the operational inventory for 5 years or have attained 6,000 flight hours of service. Deviations to this general guidance will be technically justified by the SPD.

4.1. The SPD will prepare a proposed ACI program for review by the air logistics center (ALC) and major command (MAJCOM) Maintenance Requirements Review Boards (MRRB). The program will be prepared for each MDS of aircraft. Where there are significant differences in design or use, each series of aircraft will be treated as a separate grouping for gathering condition data. Of the various possible strata of an MDS (aircraft configuration, calendar age, mission, operational environment, flying hours, etc.), normally the most severe stratum is selected for the collection of basic ACI data, with discrete tasks for suspect or critical areas added from other strata to the basic data package. Consideration should be given to including in ACI programs those aircraft being used in Controlled Interval Extension programs. ACI groups may vary by aerospace system based on peculiarities within the particular series, historical data, and differences in PDM cycles.

4.2. The SPD determines ACI groupings and quantities for review and approval by the ALC and MAJCOM MRRBs. ACI data is accrued within the approved fiscal year program. The MAJCOM MRRB is the authority for extensions to the approved ACI program.

**5. ACI Sampling Plans.** The SPD will develop a sampling plan before the start of an ACI program. The plan will address the problem for which the inspections are to be conducted and will include the following:

5.1. The inspection requirements and schedule (time and place).

5.2. The sample size needed.

5.3. A definition of the anticipated defect conditions.

5.4. Any assumptions made.

5.5. A stratification of the force.

5.6. A summary of what necessary actions are projected based on the anticipated ACI findings. The sampling plan will be documented and maintained for use with later ACI analyses for the same MDS

aircraft. A summary of the ACI sampling plan is included in the PDM brochure, if one exists, for review by the ALC and MAJCOM MRRBs.

**6. ACI Samples.** Primary sampling isolates any defect that exists in 20 percent or more of the force at a 90 percent confidence level. The primary sample size in the figure below indicates the number of aircraft to be sampled for various force sizes. It should be noted that for small force sizes (up to 36 aircraft) the sample size was considered excessive to reach the 90 percent confidence level. As a result, an arbitrary one quarter of the force was selected as a practical sample size. This reduces the confidence level for small forces to as low as 53 percent. Tasks related to highly suspect/critical areas should be sampled at the 90 percent confidence level. Tasks related to highly suspect/critical areas should not be ACI sampled when the fleet size is 36 aircraft or less. These tasks should be handled as special inspections that provide a higher confidence level.

6.1. The sample below is based on locating at least one defect, if that defect exists in at least 20 percent of the force. It is possible to isolate a single find defect, i.e., one that does not exist elsewhere in the force. To rule out single find defects, a secondary sample (for the specific item) must be taken. The secondary sample size column indicates the additional samples that must be taken without finding another defect, to be 90 percent confident that the defect existence is below a 20 percent prevalence level. If, however, these additional samples reveal another defect, it can be assumed the defect exists in 20 percent or more of the force. For example, if a major or critical defect (defined at paragraphs 8.1.2 and 8.1.3) is found in a primary sample of 11 aircraft, an additional 13 aircraft will be inspected for a total of 24 aircraft.

**Table 1. Sample.**

| Force Size | Primary Sample | Secondary Sample |
|---|---|---|
| 1-36 | 25% of force | Additional 25% of force |
| 37-199 | 10 | 13 |
| 200 + | 11 | 13 |

6.2. The sample size and selection criteria specified do not constitute a statistically valid sample of the MDS population according to statistical probability theory. They do, however, provide the most practical sampling of the worst case aircraft to provide the SPD an early indication of the force airworthiness and enable the determination of the need for additional maintenance requirements or modifications.

6.3. The selection of ACI sample aircraft will be finalized by coordination with the using command or commands.

**7. ACI Work Specifications.** ACI work specifications will be designed to identify hidden defects, deteriorating conditions, corrosion, fatigue, overstress and other deficiencies in the aircraft structure or systems. Work specifications are divided into annual and phase tasks.

7.1. Annual tasks in the work specification will commence with 0001 and continue to 2000.

7.2. Phased tasks in the work specification will start at 2001 and continue as necessary.

7.3. New tasks in the work specification will be indicated by a marginal bar.

7.4. For ACI tasks no longer required, the identification number and title will be retained on the work specification master list. The last year of accomplishment will be indicated as well as its disposition, e.g., moved to PDM, deleted, added to -6 technical order, etc.

7.5. On the work specification master list**,** the page on which the task is illustrated will be listed.

**8. ACI Reporting.** The SPD will specify the format in which ACI results will be documented to ensure the engineering activity is provided a basis for review and evaluation.

8.1. When a defect is found during an ACI, the performing activity will initially classify the defect using one of the three following categories:

8.1.1. Minor defect. A defect that is not likely to reduce materially the useability of the aircraft for its intended purpose.

8.1.2. Major defect. A defect other than critical that is likely to result in failure or to reduce materially the useability of the aircraft for its intended purpose.

8.1.3. Critical defect. A defect that is likely to result in unsafe conditions for persons using, maintaining or depending on the aircraft, or will prevent performance of the tactical function of the aircraft.

8.1.4. Reporting. The SPD will establish procedures to ensure the priority reporting of those defects identified as major or critical.

**9. Responsibilities.** This instruction assigns the following responsibilities:

9.1. MAJCOM MRRB.

9.1.1. Exercises surveillance over ACI programs.

9.1.2. Reviews annually (as part of the PDM program review, if one exists) proposed ACI programs and the results of existing ACI programs.

9.1.3. Approves extensions to existing ACI programs.

9.2. ALC MRRB. Reviews annually (as part of the PDM program review, if it exists) proposed ACI programs and the results of existing ACI programs.

9.3. SPD.

9.3.1. Sets up and monitors required ACI programs for assigned aircraft.

9.3.2. Determines ACI program requirements and develops the ACI sampling plans for assigned aerospace systems.

9.3.3. Encourages the using commands to participate in the ACI program by requesting their recommendations on ACI program requirements.

9.3.4. Establishes ACI program requirements as early as possible in each fiscal year to facilitate program approval and implementation.

9.3.5. Prepares work specifications for the accomplishment of ACI requirements.

9.3.6. Formulates the proposed ACI program and submits for ALC and MAJCOM MRRB review (as an integral part of the PDM program package, if it exists).

9.3.7. Summarizes results of ACI programs and submits for ALC and MAJCOM MRRB review (as an integral part of the PDM package if one exists).

9.3.8. Analyzes ACI data and correlates with data from PDM, field reports, material deficiencies, accident reports and incident reports to resolve the findings.

9.3.9. Makes adjustments to technical order inspection requirements as required by analysis of ACI data.

9.3.10. Participates to the extent feasible in ACI inspections when deficiencies are found that are considered critical.

9.3.11. Specifies the format in which ACI results will be documented and establishes procedures to ensure the priority reporting of those defects identified as major or critical.

9.3.12. Solicits inputs from the aircraft corrosion and ASIP managers regarding ACI requirements.

9.3.13. Coordinates inspection techniques for ASIP critical points with the ASIP Manager.

9.3.14. Coordinates corrosion detection, correction and prevention techniques with the corrosion manager.

9.3.15. Provides corrosion and ASIP Managers with ACI program results.

9.4. Source of Repair (Organic or Contract).

9.4.1. Accomplishes ACIs on aircraft as programmed by the SPD.

9.4.2. Reports ACI results according to the format and process set up by the SPD.

**10. Interface With Other Programs.** ACI type reports of PDM inspections conducted on CIE and baseline PDM aircraft will provide data for analysis under the CIE program. Consideration should be given to combining ACI, PDM and CIE programs on the same aircraft.

GARY D. DECKARD, Col, USAF
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## Attachment 1

## GLOSSARY OF TERMS AND ABBREVIATIONS

***Terms***

**Aircraft Structural Integrity Program (ASIP)—**A time-phased set of required actions performed at the optimum time during the life-cycle (design through phase-out) of an aircraft system to ensure the structural integrity (strength, rigidity, damage tolerance, durability and service life capability) of the aircraft.

**Analytical Condition Inspection (ACI)—**The systematic disassembly and inspection of a representative sample of aircraft to find hidden defects, deteriorating conditions, corrosion, fatigue, overstress and other deficiencies in the aircraft structure or systems. ACIs are normally over and above those inspections specified in the technical order or PDM work specifications.

**Controlled Interval Extension (CIE)—**The controlled extension of a PDM interval based on condition analyses of a representative sample of aircraft.

**Maintenance Requirements Review Board (MRRB)—**A panel that assures all valid depot level maintenance requirements are evaluated and scheduled for appropriate fiscal year accomplishment. The process for the assurance involves an annual on-site review of the proposed maintenance program for each weapon system to assess the depot interval, the time in depot (flow days), and the validity of each detailed task in the work package. The panel is comprised of using command representatives and AFMC engineering, funding and aircraft maintenance experts. Changes to an approved maintenance program must be submitted with complete justification to the MRRB prior to incorporation in the work package and submission for funding. MRRBs are convened at the ALC and MAJCOM levels.

**Programmed Depot Maintenance (PDM)—**Depot level inspections and maintenance scheduled on a cyclic basis.